I CLAIM:

1. A metal chalcogenide composite nano-particle comprising a metal capable of forming p-type semiconducting chalcogenide nano-particles and a metal capable of forming n-type semiconducting chalcogenide nano-particles, wherein at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV and the concentration of said metal capable of forming p-type semiconducting chalcogenide nano-particles is at least 5 atomic percent of said metal and is less than 50 atomic percent of said metal.

2. Metal chalcogenide composite nano-particle according to claim 1, wherein said metal chalcogenide composite nano-particle comprises a p-type semiconducting metal chalcogenide phase and a n-type semiconducting chalcogenide phase, at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV and the concentration of said p-type semiconducting metal chalcogenide in said metal chalcogenide composite nano-particle is at least 5 mole percent and is less than 50 mole percent.

3. Metal chalcogenide composite nano-particle according to claim 1, wherein said metal chalcogenide composite particle is a coprecipitated particle.

4. Metal chalcogenide composite nano-particle according to claim 1, wherein said metal chalcogenide composite particle is a metal sulphide composite particle.

5. Metal chalcogenide composite nano-particle according to claim 1, wherein said metal capable of forming n-type semiconducting chalcogenide nano-particles is selected from the group consisting of zinc, bismuth, cadmium, mercury, indium, tin, tantalum and titanium.

6. Metal chalcogenide composite nano-particle according to claim 1, wherein said metal capable of forming p-type semiconducting chalcogenide nano-particles is selected from the group consisting of copper, chromium, iron, lead and nickel.

7. Metal chalcogenide composite nano-particle according to claim 1, wherein said metal chalcogenide composite particle further

contains a metal capable of forming spectrally sensitizing chalcogenide nano-particles with a band-gap between 1.0 and 2.9 eV.

8. Metal chalcogenide composite nano-particle according to claim 7, wherein said metal capable of forming spectrally sensitizing chalcogenide nano-particles is selected from the group consisting of silver, lead, copper, bismuth, vanadium and cadmium.

9. Metal chalcogenide composite nano-particle according to claim 1, wherein a stoichiometric deficit of the chalcogenide in said metal chalcogenide composite nano-particle is present.

10. A dispersion comprising a metal chalcogenide composite nano-particle comprising a metal capable of forming p-type semiconducting chalcogenide nano-particles and a metal capable of forming n-type semiconducting chalcogenide nano-particles, wherein at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV and the concentration of said metal capable of forming p-type semiconducting chalcogenide nano-particles is at least 5 atomic percent of said metal and is less than 50 atomic percent of said metal.

11. A process for preparing a dispersion comprising a metal chalcogenide composite nano-particle comprising a metal capable of forming p-type semiconducting chalcogenide nano-particles and a metal capable of forming n-type semiconducting chalcogenide nano-particles, wherein at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV and the concentration of said metal capable of forming p-type semiconducting chalcogenide nano-particles is at least 5 atomic percent of said metal and is less than 50 atomic percent of said metal, comprising the steps of preparing a composite metal chalcogenide nano-particle containing an n-type semiconducting chalcogenide and a p-type semiconducting p-type semiconducting chalcogenide, wherein at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV.

12. Process according to claim 11, wherein said process further includes a coprecipitation step, a metal ion conversion step and/or a sintering step.

13. Process according to claim 11, wherein said coprecipitation is carried out in a medium containing at least one compound selected from the group consisting of thiols, triazole compounds and diazole compounds.

14. Process according to claim 11, wherein said process includes the step of mixing said metal chalcogenide composite nano-particles with spectrally sensitizing chalcogenide nano-particles with a band-gap between 1.0 and 2.9 eV.

15. Process according to claim 11, wherein said process comprises the step of converting said metal chalcogenide composite nano-particles with metal ions.

16. Process according to claim 11, wherein said process further includes a diafiltration process.

17. Process according to claim 16, wherein the washing medium in said diafiltration process contains a phosphoric acid or a phosphoric acid salt.

18. A layer comprising metal chalcogenide composite nano-particles comprising a metal capable of forming p-type semiconducting chalcogenide nano-particles and a metal capable of forming n-type semiconducting chalcogenide nano-particles, wherein at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV and the concentration of said metal capable of forming p-type semiconducting chalcogenide nano-particles is at least 5 atomic percent of said metal and is less than 50 atomic percent of said metal.

19. Layer according to claim 18, wherein said layer further contains at least one spectral sensitizer for said metal chalcogenide composite nano-particles.

20. Layer according to claim 19, wherein said at least one spectral sensitizer is selected from the group consisting of metal chalcogenide nano-particles with a band-gap between 1.0 and 2.9 eV, organic dyes, and metallo-organic dyes.

21. Layer according to claim 18, wherein said layer further contains a binder.

22. Layer according to claim 21, wherein said binder is poly(vinyl pyrrolidone).

23. A photovoltaic device comprising a layer comprising metal chalcogenide composite nano-particles comprising a metal capable of forming p-type semiconducting chalcogenide nano-particles and a metal capable of forming n-type semiconducting chalcogenide nano-particles, wherein at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV and the concentration of said metal capable of forming p-type semiconducting chalcogenide nano-particles is at least 5 atomic percent of said metal and is less than 50 atomic percent of said metal.

24. A process for using a metal chalcogenide composite nano-particle comprising a metal capable of forming p-type semiconducting chalcogenide nano-particles and a metal capable of forming n-type semiconducting chalcogenide nano-particles, wherein at least one of said metal chalcogenides has a band-gap between 1.0 and 2.9 eV and the concentration of said metal capable of forming p-type semiconducting chalcogenide nano-particles is at least 5 atomic percent of said metal and is less than 50 atomic percent of said metal, in a photovoltaic device.